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# THE PAJAROELLO TICK (*ORNITHODORUS CORIACEUS* KOCH)

WITH SPECIAL REFERENCE TO LIFE HISTORY AND BITING HABITS

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For several years previous to beginning his observations on this species, the writer has listened to many harrowing tales about the *Pajaroello*. No one seemed to know exactly what it was and no one seemed to have collected specimens so as to make accurate identification possible in so far as the writer knew at the time. Complaints came almost exclusively from the more mountainous portions of Santa Clara and San Benito Counties (California). Natives, principally Mexicans, in the vicinity of Mt. Hamilton fear this parasite more than they do the rattlesnake, and tell weird tales of this or that man having lost an arm or leg, and in one instance even death having ensued, as the result of a bite by the Pajaroello. There seems to be a superstition in that region that three bites will result in certain death. The stories all agree in the essential detail that the bite results in an irritating lesion which is slow to heal and often leaves an ugly deep scar. Several persons also informed the writer that the Pajaroello occurred in certain mountainous portions of Mexico. It was not, however, until August, 1913, that living specimens came to hand, taken in Santa Clara County in the vicinity of Mt. Hamilton. These were identified as *Ornithodoros coriaceus* Koch, described in 1844 from a single female specimen from Mexico. A translation by Nuttall of the original description is as follows:

"Shaped like the sole of a shoe, thick margined, roughly shagreened, yellowish earthy color, spotted rusty red, legs toothed dorsally. Length 9.3 mm. Body about twice as long as wide, width fairly uniform, indented on the sides, pointed above the mouthparts, rounded posteriorly, a thick turned-up border all around; the whole surface above and below thickly granulated like fish skin (shagreen), the granules flat above, consequently, the whole leathery, on the back unequal folds and grooves. Beneath in the front of the body a deep groove running to the stigmata and on the inner protrusion the rather large round quite clearly marked eyes. The coxae gradually thicken toward the distal extremity and are somewhat bent; the other articles somewhat compressed and clearly notched or round-toothed. The whole surface, above and below, dirty yellowish earthy color, rusty red spots irregularly distributed throughout. Capitulum and palps light yellow. Legs gray-brown. Female. Male: unknown. Habitat: Mexico."

From either specimens received or reliable information at hand it now seems evident that this species occurs in the more mountainous portions of the following counties in California, namely, San Benito, Santa Clara, Stanislaus, Monterey and Santa Barbara, probably also Los Angeles and San Diego, thus connecting up with Mexico, which is probably the original habitat. The tick is most commonly found among the dry leaves beneath live oak trees where cattle are accustomed to lie in the shade. Most cases of tick bite caused by this species have occurred while sitting or lying down in such situations.

This species of tick is a typical representative of the genus *Ornithodoros* of the family Argasidae and is superficially not greatly unlike the relapsing fever tick of Africa, namely, *Ornithodoros moubata* Murray.

Since August, 1913, the complete life history of this tick has been worked out and much information has been gained relative to its habits and venomous properties. In this work the writer has been greatly assisted by several of his advanced students, notably Mr. W. L. Chandler, who has undertaken an exhaustive study of this species.

#### LIFE HISTORY

Six adults and half-grown specimens, males and females, were secured during the month of August, 1913. Of these Tick No. 6, a fully grown female, engorged on blood from a Rhesus monkey, November, 1913, deposited a lot of eggs Feb. 13, 1914, and continued to lay eggs at intervals during the rest of that season. Various experiments were performed with the ova and the several larvae resulting from the first laying, mainly for the purpose of determining the best method of procedure. From the second laying of this tick we secured our first complete life history data as follows: March 9, Tick No. 6 deposited 323 ova, hatched March 31; giving an incubation period of about 21 days at an incubator temperature averaging 26.3 C. (variation  $\pm 1$  C.). The larvae were placed on the ear of a rabbit May 2 and among others one was recovered fully engorged May 11, and given the number 18. The first moult occurred May 21, giving about 51 days for the larval stage in this instance. The second moult without a second engorgement took place June 15. The nymph became fully engorged in about twenty minutes on July 2, the third moult occurring August 12. Becoming fully engorged again October 11, the fourth moult took place December 23. Engorging again Jan. 16, 1915, the fifth moult took place March 9 and the sexually differentiated tick (a female) appeared. March 27 it became fully engorged on a mouse and was placed with male No. 3 on April 16, copulation taking place April 17. The first laying consisting of 428 eggs took place June 10, 1915. Thus the egg to egg period in this

individual covered exactly fifteen months. This time can be reduced very considerably by applying the ticks to a suitable host animal at shorter intervals, indeed we have one record of a male in which sexual differentiation was accomplished in 159 days, as against 343 days in Tick No. 18, a female. Under natural conditions it seems quite probable that there is one generation each year and that two years may be necessary in many instances.

Although the incubation period at a given sustained temperature suffers little variation, e.g. at 26 C. it is 21 days, the length of time required for the other stages varies considerably, depending on the presence of a host mainly.

The minimum length of the larval period was found to be 19 days. The number of moults varies from four to seven.

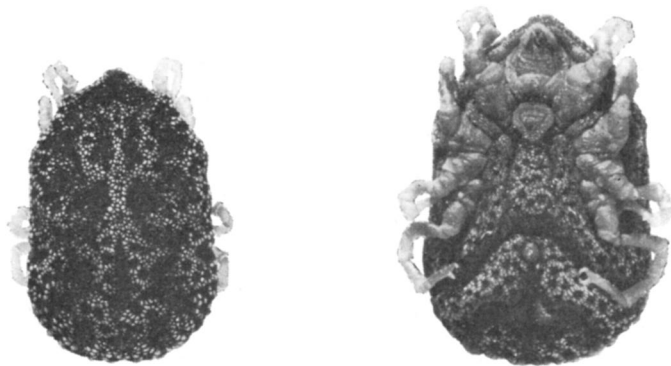


Fig. 1.—The Pajaroello tick, *Ornithodoros coriaceace* Koch. Dorsal, left; ventral, right.

The length of time a female may remain fertile without further copulation is at least two years as shown by the fact that Tick No. 6 received as a fully grown individual August, 1913, and not thereafter placed with a male, deposited eggs during the summer of 1914 and 1915. The total number of eggs deposited in one season by Tick No. 6 was 1,158, there being seven separate layings. The maximum number of eggs deposited in a single lot for the year 1914 by Tick No. 6 was 323. This same tick, however, deposited 802 eggs April 26, 1915, her tenth laying in captivity, and her daughter, Tick No. 18, deposited 428 in her first laying.

We have experienced no little difficulty in rearing this species of tick. However, the ear of a rabbit is best suited for feeding the larval ticks; later stages are best fed by placing the ticks either on a rabbit or on a mouse, holding these with the hands until the ticks have become fully engorged and drop off, this process requiring from 15 to 30 minutes.

## BITING HABITS AND VENOMOUS NATURE

Mr. W. L. Chandler, a graduate student in the University of California, formerly with the United States Public Health Service, has given the writer an accurate account of two bites which he suffered while stationed in the San Antone Valley (California). The first bite was received July 2, 1912. He experienced a sharp pain on the left arm and upon rolling up his sleeve discovered a large tick, partly engorged, attached to the upper arm in front. He dislodged the tick and sucked the lesion. The lesion when first discovered showed a small dark purple ring surrounding a bright red spot, the point of attachment. The discoloration disappeared in a short time but the arm was "highly irritable for two or three days and at the point of attachment a minute clear scab formed." The tick proved to be a pajaroello.

The second bite took place July 16 while seated in a thicket of willows (the first bite took place while riding over a brush grown hill), and in this case the sharp pain involved the left leg. An almost fully engorged tick, again a pajaroello, measuring about three-fourths of an inch in length and about one-half inch in width was removed from just above the shin. Once more a bright red spot was visible at the point of attachment surrounded by an irregular purple ring about three-fourths of an inch in diameter. In about half an hour the leg began to swell in the vicinity of the lesion and in about three hours the entire lower leg was tremendously swollen. The coloration about the point of attachment had widened considerably, was puffy and a clear lymph exuded from the lesion. The young man lanced the leg causing the blood to flow freely and treated the wound with crystals of potassium permanganate, binding the leg with cotton and gauze. During the following night he reports experiencing a general disagreeable feeling, the entire lower leg being "irritable and numb." On the following day the bite on the arm became irritable again, and was treated as had been the leg, fearing bad results. For several weeks both lesions exuded a clear lymph from beneath an "oily looking, transparent, red mottled scab, which remained in evidence for two or three months."

Chandler reported these ticks very numerous in some localities, having counted as high as six within half an hour crawling over a saddle blanket placed on the ground. Their presence and number seemed to be determined by the presence of cattle, although ticks were found where there were no cattle but in places which were evidently favorite haunts of wild animals.

## EXPERIMENTS WITH THE PAJAROELLO

*On monkeys:* A number of specimens of *Ornithodoros coriaceus* were collected in the San Antone Valley and at Newman, California, for purposes of experimentation and study of life history. In coopera-

tion with Dr. W. A. Sawyer and Messrs. S. W. Newman and W. L. Chandler, the writer conducted a number of experiments particularly with reference to the bite. In one of these experiments a mature female tick was permitted to bite a nearly full grown monkey (*Macacus rhesus*) twice within an interval of sixteen days intervening between the two bites. The tick was applied at 9:42 a. m. Dec. 10, 1913, and began sucking blood at 9:43, one minute later, becoming engorged and falling off at 10:21 a. m., a period of 38 minutes. At 10:30, a few minutes after the tick dropped off, there appeared a deep red hemorrhagic area 2 mm. in diameter at the point of biting with a somewhat lighter area 10 mm. in diameter surrounding the central area. At 10:47 there was a black spot at the point of bite 1.5 mm. in diameter. the inner red hemorrhagic area measuring 4 mm., with a yellowish white area surrounding this 8 by 6 mm., and an outer petechial area 15 by 13 mm. No general symptoms were noted. The lesion reached its greatest expanse the following day when the following measurements were taken: dark purple spot 2 mm. in diameter (a very dark red scab); the inner red area 6 by 5 mm., the yellowish white area 20 by 12 mm., the outer area 48 by 23 mm. and fading. The yellowish white area including bite was slightly swollen. By December 14, i.e. four days after the bite was received, the ecchymosis had entirely disappeared; by December 16, six days after the bite, the lesion was entirely gone but for a slight pigmentation, a thickened reddish area measuring 5 by 3 mm. and a small scab 2 mm. in diameter.

The monkey remained normal throughout the experiment as regards temperature, weight, blood count and general condition.

The second bite was received by the same animal on December 26, the tick being applied at 9:43 a.m., taking hold at 9:44 a.m. and dropping off fully engorged at 9:55 a.m., requiring but 11 minutes to engorge. The history of the second bite follows that of the first very closely, except for the extent of the lesion which was greater, i.e. 70 by 30 mm. In order to note any manifestation on the part of the first lesion, the second bite was located near the opposite nipple. No change was observed. The lesion produced by the second bite had disappeared by December 31, i.e. five days after the bite, except for a slight thickening 3 mm. in diameter and a slight white scale at the center. Again the monkey had remained normal, except for a slight increase in the count of white blood corpuscles which rose from 7,400 at the time of the bite to 13,900 by noon of the same day, going down again to 7,300 by 5 p.m.

Both nymphs and adults readily attach to man, monkey, rabbit and mouse; and become fully engorged in from 15 to 30 minutes, depending on the number and length of rests in the rhythmic motion of the basis capituli. If dislodged while engorging, they, like the larvae, refuse to reattach immediately.

*On rabbits:* The bite on a rabbit's ear leaves a comparatively large, thick, purple nodule, and is accompanied by a more or less hemorrhagic condition of the entire ear tissue. The bite has no apparent systemic effect on the rabbit, and the lesion heals within two or three weeks.

*On mouse:* When a tick was applied to the body of a mouse for the first time, the mouse showed no apparent uneasiness until the tick attempted to withdraw its head. Beginning immediately after the tick dropped from the mouse there occurred a small swelling which exuded lymph, rapidly grew in proportions and was accompanied by marked ecchymosis. In 2 minutes after the tick had dislodged itself the swelling had increased its area 0.3 by 1 cm., in 30 minutes 0.5 by 2 cm., and in one hour 0.5 by 2.5 cm. After 24 hours the swelling had become reduced, except in the vicinity of the bite, and fully one half of the mouse was dark blue. But slight systemic disturbances were noticeable in the mouse, and it rapidly recovered. The same mouse was used as a host for other ticks, and each succeeding bite produced less and less noticeable results, until finally only very slight lesions were produced.

#### SUMMARY

The venomous Pajaroello Tick ("Pajahuello" according to Banks) is a native of Mexico, but is now known to occur in the more mountainous coastal counties of California as far north as Santa Clara within 100 miles of San Francisco.

The breeding habits, metamorphosis and life history have been carefully observed in the Parasitology Laboratory of the University of California. . Records of life history in individual cases (i. e., from egg to sexual maturity) show 159 days for the male and 343 days for the female at a temperature averaging 26.3 C. (variation  $\pm 1$  C.). The venomous nature of the bite as affecting man, monkey, rabbit, and mouse is described.